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Morphology of small-scale contouritic depositional systems associated to topographic heights at the Galician margin (NW-Spain)

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Contouritic depositional systems (CDS), sedimentary structures which comprise depositional as well as erosional features, occur at the Galician margin in various geometries and on relatively small scales (~2-20 km). They result from the interaction northward flowing contour currents with a complex basement topography, which is partly visible in the bathymetry as isolated heights (outliers), a plateau attached to the upper slope and two east-west oriented ridges. Such topographic features acts as obstacles, which locally perturb the bottom-currents subsequently leading to the development of associated CDS. These CDS have been identified and categorized based on their varying internal geometries and surface expression observed in bathymetric and multichannel seismic data collected during RV Meteor Cruise M84/4 (2011).

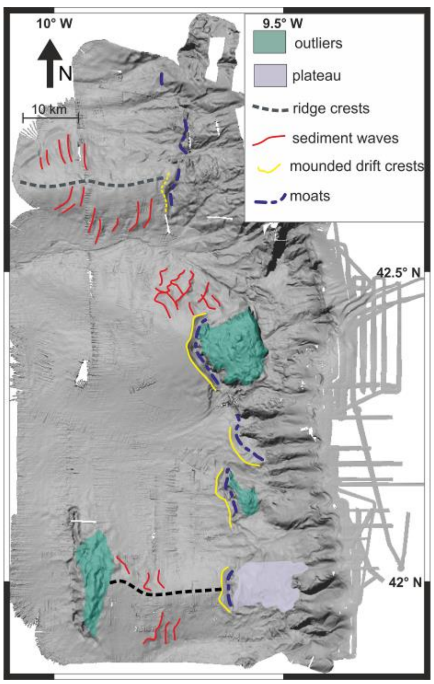

Figure 1 – Interpreted bathymetry of the study area

The major category of CDS are mounded sediment drifts which are separated by moats west of the plateau and two of the outliers. Less pronounced examples without topographic obstacle can be found along the slope (Fig1). As second category, sediment waves have been identified along the ridge flanks and at the lee side of the largest outlier. The sediment waves on the ridge are oriented perpendicularly to the ridge crest and parallel to the main current direction, indicating that the bottom-current is deflected to overflow the ridge oblique or even along the ridge contours. The sediment waves at the lee side of the outlier exhibit two crossing sets of crests, which implicates two different current directions during formation. On the plateau several upslope migrating depocenters with adjacent erosional features developed. Their spatial distribution is linked to steps in the underlying topography which presumably splits the bottom current into several current cores. Thus this CDS was identified as multiple crested drift.

The relatively small size of the study area along the main current direction (<120 km) allows the assumption that the oceanographic forcing of the bottom current does not change spatially, but different CDS geometries and sizes are solely a result of the different interaction of the current with pre-existing topography. In addition to this qualitative analysis of the morphologies, the repetition of mounded drifts and moats around two outliers and along the plateau, facilitated a first quantitative morphological analysis of the relation between obstacle and CDS. Systematic, high-resolution analysis of moat depth and width, obstacle height and width as well as the cross section areas of both was used to test the hypothesis that obstacle width and cross section are the prime factors impacting moat depth and width, as they determine the change in current diameter. Surprisingly, the strongest correlation is found between obstacle height and moat cross-section. Thus, the here presented data set can be utilized to develop new required conceptual models for the impact of obstacle morphology on CDS architecture and development, and on a broader scale, to study the impact of tectonics during margin evolution on contouritic sedimentation.